Measures of parallelograms

A **parallelogram** is a quadrilateral that has opposite sides that are parallel. The parallel sides let you know a lot about a parallelogram. Here are the special properties of parallelograms:

Parallelogram

Two pairs of opposite parallel sides

Opposite sides are equal lengths

Opposite angles are congruent

$$m\angle 1 = m\angle 3$$

$$m\angle 2 = m\angle 4$$

Consecutive angles are supplementary

$$m\angle 1 + m\angle 2 = 180^\circ$$

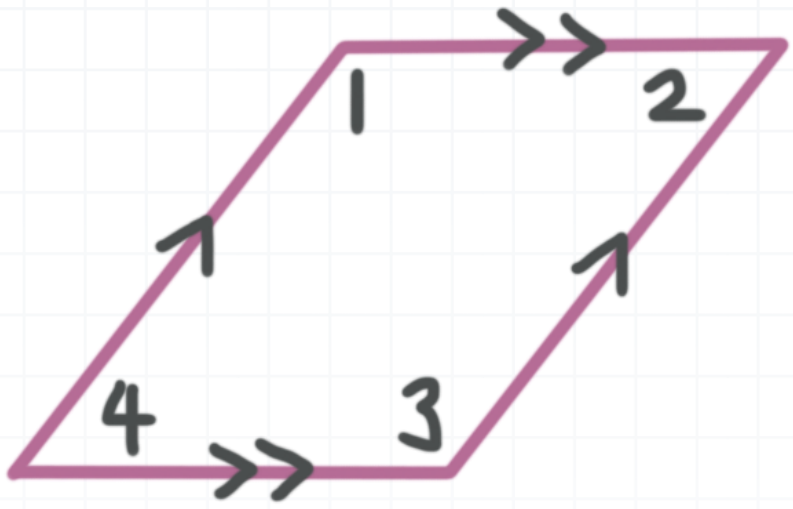
$$m\angle 2 + m\angle 3 = 180^\circ$$

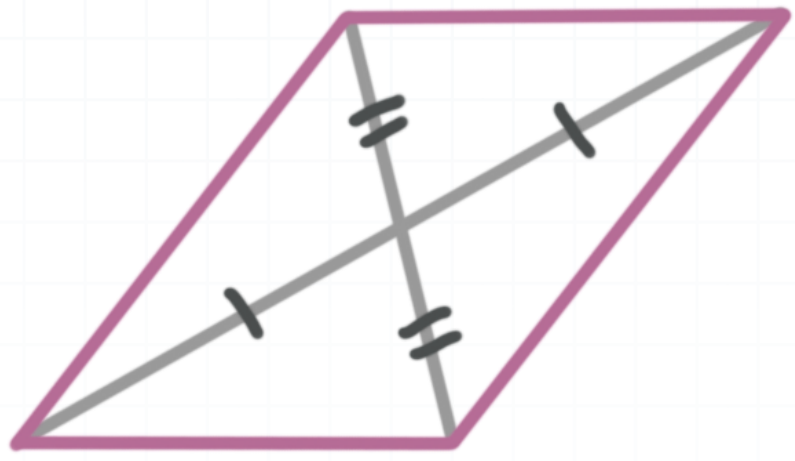
$$m\angle 3 + m\angle 4 = 180^\circ$$

$$m\angle 4 + m\angle 1 = 180^\circ$$

Diagonals bisect each other (cut each other in half)

© Krista King Math

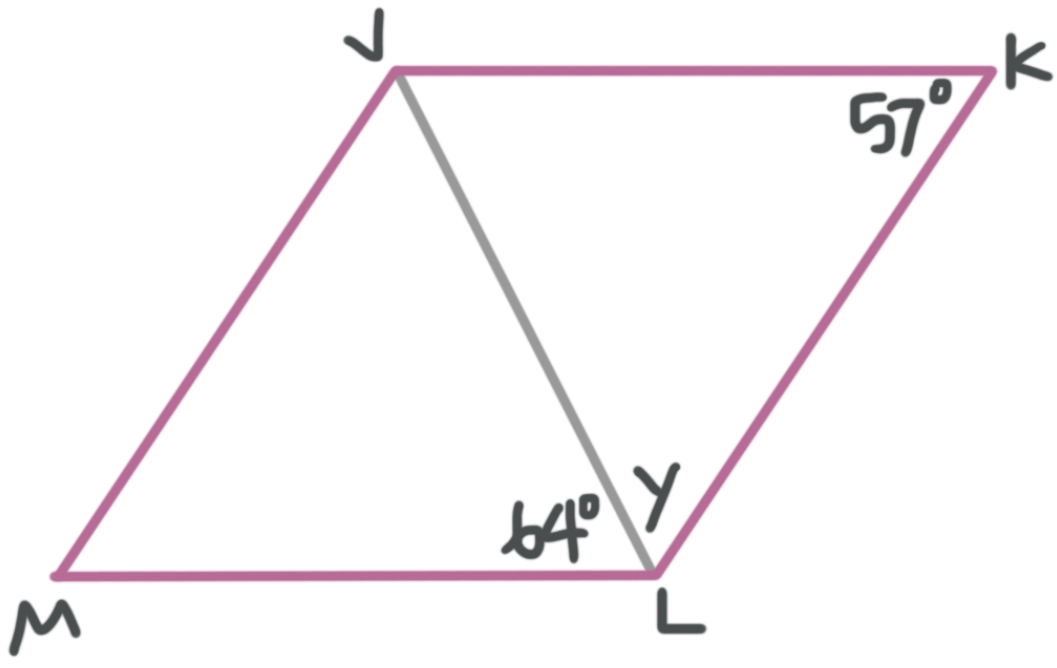




Let's look at a few examples.

Example

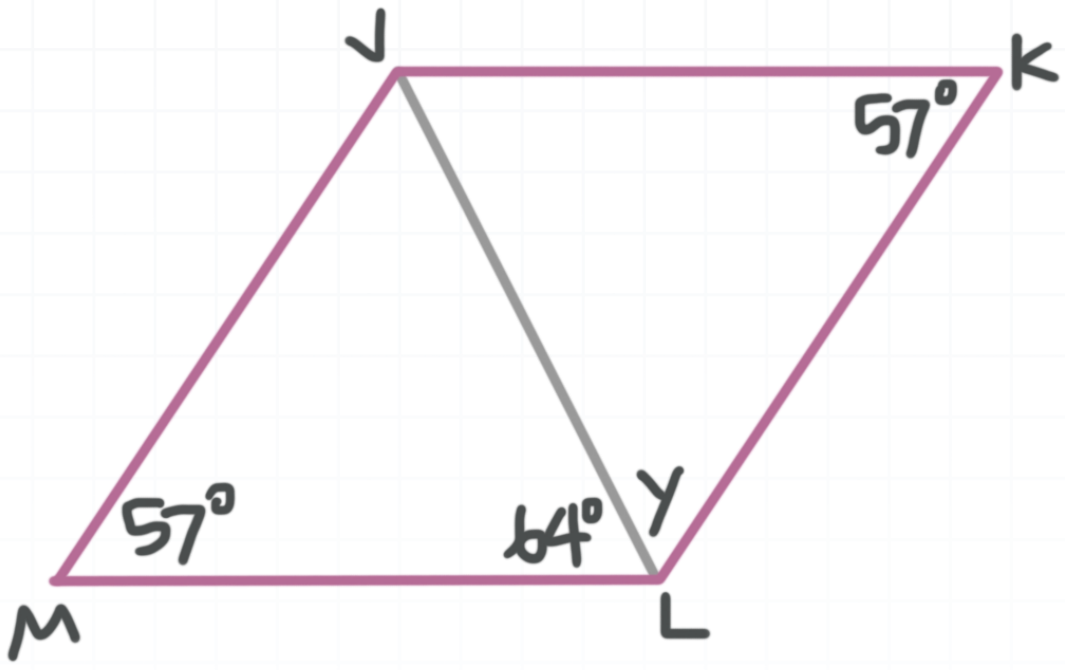
Find the measure of angle y, given $JKLM$ is a parallelogram.



© Krista King Math

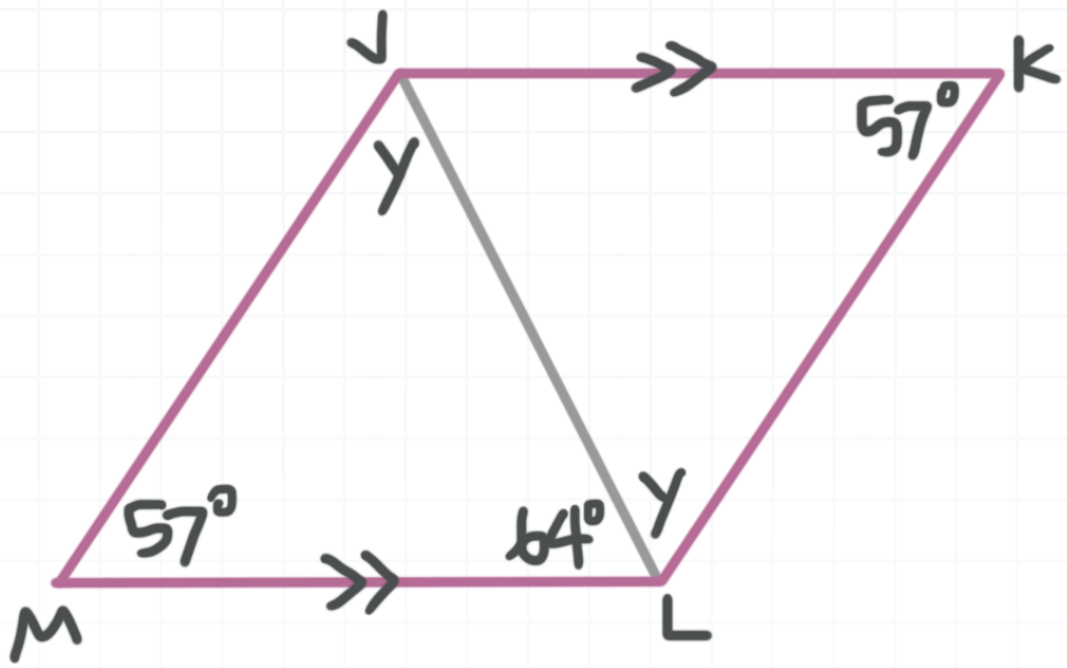
Opposite angles of parallelograms are congruent, so

$$m\angle JML = m\angle JKL = 57°$$



Now we can use the fact that opposite sides of a parallelogram are parallel to state that $JK \parallel ML$. This means that the diagonal JL of the parallelogram is also a transversal of these two parallel lines. This means that $\angle KLJ$ and $\angle MJL$ are alternate interior angles. Alternate interior angle pairs are congruent, so $m\angle KLJ = m\angle MJL = y$.

© Krista King Math



Now we have the angles in $\triangle JML$ and the angles all sum to $180°$. We can set up an equation and solve for y.

$$y + 57° + 64° = 180°$$

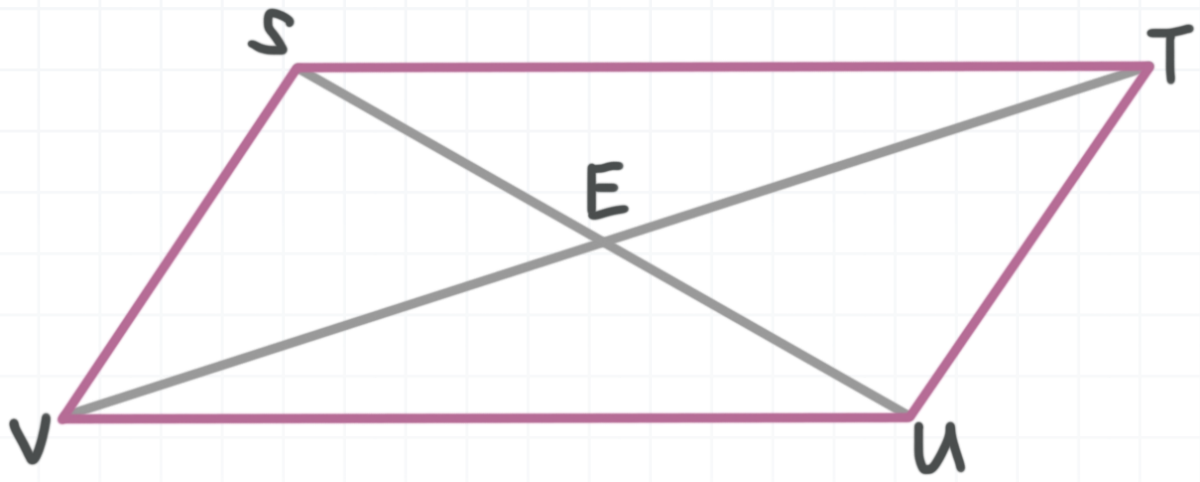
$$y = 59°$$

Let’s do an example that involves the diagonals of a parallelogram.

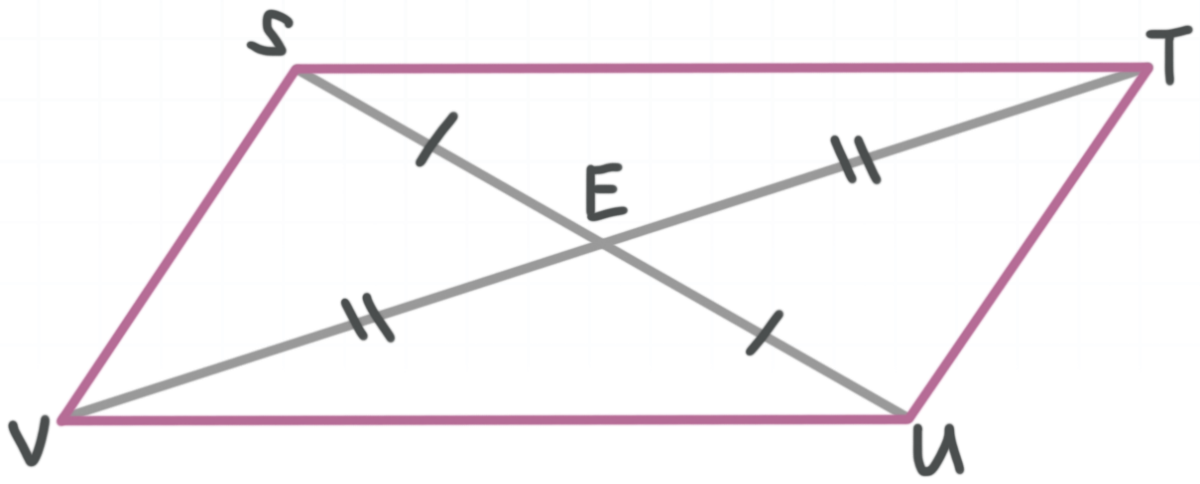
Example

If $STUV$ is a parallelogram, and if $VT = 4n + 34$ and $VE = 7n - 3$, what is the length of ET?

© Krista King Math



We know that the diagonals of a parallelogram bisect each other. Let's add this information into the diagram.



Now we can see the relationships we need. Because the diagonals bisect, $VE = ET$ and $VE = (1/2)VT$. We can use what we know to find the length of VE and then we'll know the length of ET as well.

$$VE = \frac{1}{2}VT$$

$$7n - 3 = \frac{1}{2}(4n + 34)$$

$$7n - 3 = 2n + 17$$

© Krista King Math

$$5n = 20$$

$$n = 4$$

Now we can substitute back in to find the length of VE, which is equal to the length of ET.

$$VE = ET = 7n - 3$$

$$VE = ET = 7(4) - 3$$

$$VE = ET = 25$$

© Krista King Math